Visual direction discrimination with and without smooth pursuit.

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It has long been known that ocular pursuit of a target has a major influence on the resulting perceived speed of that target (Aubert, 1886; Fleischl, 1882). However, little is known about the effect of smooth pursuit on the perception of target direction. Here, we compare human direction discrimination under two eye-movement conditions (pursuit vs. fixation), two stimulus duration conditions (200 vs. 750-850ms), and two direction conditions (cardinal vs. oblique). The stimulus was a red spot moving at 10?/s along a straight path tangential to an invisible circle ~5 deg in diameter. Four observers were presented with two sequential intervals of stimulus motion: a standard at one of eight directions (four cardinals and four primary obliques) jittered by ?3?, and a test differing from that standard by ?2, ?4, ?6, or ?8?. Observers were asked to report the interval that contained the more clockwise direction of motion. In separate blocks, observers were either required to pursue the target dot or to maintain central fixation, using a 240Hz video-based eye tracker (precision: ~0.1 deg) to verify compliance. Performance was similar in the fixation and pursuit conditions. Furthermore, the two conditions showed a similar oblique effect, which was larger in the long duration condition. The mean direction uncertainty for cardinal directions was 4.6 ? 1.0? (? SD across observers) and 4.4 ? 1.2? during fixation and pursuit respectively for the long duration, and 6.2 ? 1.4? and 7.6 ? 1.7? respectively for the short duration. Uncertainty for the oblique direction was 2.2 ? 0.7 and 2.4 ? 0.3 times larger for fixation and pursuit for the long duration, but only 1.6 ? 0.3 and 1.4 ? 0.1 larger, respectively, for the short duration. Our data show that, despite the different retinal stimulation, performance was nearly identical with or without pursuit, whether or not the stimulus presentation was restricted to the "open-loop" period of peripheral viewing prior to pursuit onset, or included information from the foveal viewing experienced during the "steady-state" period of tracking.

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